# Farm & Home Science Vol. 5 No. 1, March 1944

# FARM & HOME SCIENCE

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UTAH AGRICULTURAL EXPERIMENT STATION

Vol. 5 March 1944 No. 1

## Getting the Most Out of Fertilizers

**Restricted Amounts of Fertilizers Must Be Used Where They Will Produce the Greatest Returns in Crop Production**

By D. W. THORNE and H. B. PETERSON

HIGH prices and war needs should stimulate every farmer to strive harder than usual this year for maximum production. This should mean that he will select the best seed available, give greater care in the preparation of seed beds, and give more careful attention to soil treatment with farm manure and commercial fertilizers. Probably no farm operation can be approached more scientifically than the selection and use of fertilizers.

The value of commercial fertilizers in crop production is just beginning to be appreciated by the majority of Utah farmers. This has meant a greatly increased demand for these materials in recent years. Because of the war program, however, there will probably be insufficient fertilizer available in Utah this year to meet the demand. Farmers who wait until planting time to look for fertilizer are sure to be disappointed. Consequently every farmer who plans to use fertilizer should go to his dealer and place an order for this year's needs immediately. To extend the limited supply it is necessary to regulate the amount that can be purchased by each farmer. These regulations have been published in a recent issue of the Utah Farmer. To insure that the maximum returns will be gained from the use of fertilizers the soil and cropping program on each farm should be carefully harmonized with correct fertilizer practices.

### Fertilizer Materials and Substitutions

The most important fertilizer materials sold in Utah as sources of chemical nitrogen are: ammonium sulfate, 20-0-0; sodium nitrate, 16-0-0; and ammonium nitrate, 34-0-0. In addition, some organic nitrogen materials such as sewage sludge, dried blood, etc., may be available in some places. The figures in a fertilizer formula refer to percentages of fertilizer elements. Thus, a 10-20-10 fertilizer contains 10 percent nitrogen, 20 percent available phosphoric acid, and 4 percent soluble potash.

The most important phosphate fertilizer sold in this state is treble superphosphate, 0-43-0. There is also some single superphosphate, 0-20-0, being distributed by the AAA and being sold by commercial companies this year. This product should give equally as good results as the treble superphosphate if 200 lbs. of the 20 percent grade is applied for each 100 lbs. of the treble superphosphate. Finely ground raw rock phosphate, or heated rock phosphate has little or no fertilizer value on Utah soils.

Since the fertilizer recommendations are made in terms of only a few of the materials offered for sale the following notes may aid in making substitutions:

1. 100 pounds of ammonium sulfate (20-0-0) is equivalent to 125 pounds of sodium nitrate (16-0-0), or to 60 pounds of ammonium nitrate (34-0-0).
2. 100 pounds of treble superphosphate (0-43-0) is equivalent to 215 pounds of single superphosphate (0-20-0).
3. A mixture of 30 pounds of ammonium sulfate and 70 pounds of treble superphosphate can be substituted for each 100 pounds of 6-30-0.
4. Nearly 200 pounds of 4-16-0 are required to substitute for 100 pounds of 6-30-0.
5. A mixture of 50 pounds of ammonium sulfate and 50 pounds of treble superphosphate can be substituted for each 100 pounds of 10-20-0.

*(Continued on page 8)*

## BRANCH VETERINARY LABORATORY OPENED AT PROVO

By D. E. MADSEN

THE new branch Veterinary Laboratory at Provo, located at 1201 West Center, was officially opened the latter part of February. The delay in opening the laboratory was owing to the difficulty in obtaining laboratory equipment. The commissioners of Utah County provided the building.

Soon after the establishment of the Veterinary Laboratory at Logan in 1929, it became obvious that this laboratory was unable to serve adequately the livestock and poultry interests of the central and southern portions of the state. The location served admirably for points north of Salt Lake County, but the tremendous growth of the poultry industry since 1929 in central and southern Utah has increased the need of laboratory service at a more convenient location. The State Legislature meeting in 1943 appropriated funds for the establishment of such a branch laboratory to be administered by the Utah Agricultural Experiment Station.

Dr. M. L. Miner is in charge of the laboratory. Dr. Miner obtained his B.S. degree from Utah State in 1937, later he obtained his D.V.M. degree from Iowa State College, and has taken graduate work at Michigan State College. Dr. Miner comes highly recommended as a veterinary pathologist. Much of his training has been in poultry pathology.

The laboratory will not only make diagnoses of various animals and poultry ailments but will also include in its program some research work. Veterinarians, stockmen and poultrymen are invited to bring or send sick or dead specimens to the laboratory for diagnoses.

The laboratory is not an animal hospital and it is not the intention to interfere in any way with the practice of veterinarians. Its purpose is to assist them and stock owners in certain tests which require laboratory facilities.

# Clean Yards, Sheds and Barns — First Requisites for Production of Clean Milk

By GEORGE Q. BATEMAN

CLEAN yards, sheds, barns and a liberal supply of bedding are the first requisites for clean cows and clean cows are the first requisites for clean milk. Where the surroundings are clean the problem of preparing cows for milking is much simplified.

Yards, sheds and barns should be so constructed that they can be kept clean with a minimum of effort. Feed mangers and watering troughs should be surrounded by platforms to keep animals out of the manure and muck during the wet season. The platforms should be made preferably of cement, those of wood are less permanent and form shelters for rats and mice. Drainage of the yards should be away from the watering troughs and feed mangers, towards some specially constructed manure retainer where the fertilizer can be held until placed on the land.

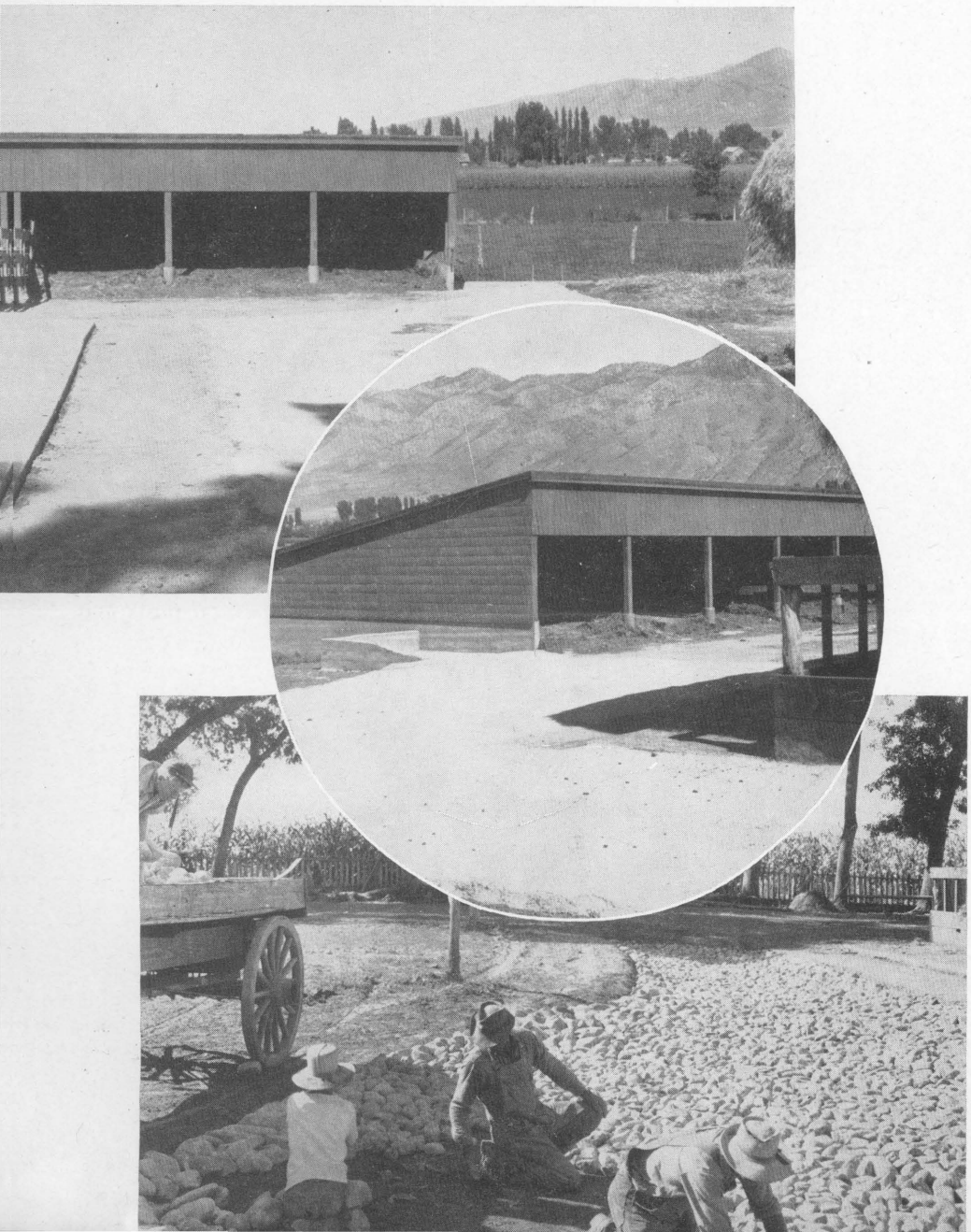
Manure should be taken directly from the barns and yards and spread on the land. This conserves fertility and labor, and leaves the surroundings in a clean condition. During the early spring or summer, manure should never be left in a pile to serve as a breeding place for flies.

### Adequate Bedding

An adequate supply of straw for bedding is another important item in keeping cows clean and healthy. The amount needed per animal per day will range from 4 to 8 pounds. The upper limit should be provided when possible. At 8 pounds per day it will require approximately 1,500 pounds per cow for the winter period. The best and most economical way to acquire an adequate supply of straw on dairy farms is to grow it along with the grain supply that is to be fed the herd. Data on production of barley on the Dairy Experimental Farm show that when a six year average of 88 bushels of barley was produced per acre, the straw harvested amounted to 3,550 pounds per acre for the same years. At this yield, one acre of barley would supply enough straw to bed 2.4 cows and in addition the grain requirements for 2 high producing cows. Four to six acres of high-yielding barley would furnish a satisfactory straw supply for a herd of 10 to 15 head. Straw returns dividends to the dairy farmer in the following ways: It keeps the cows clean; gives them a comfortable bed, and protects the udder from injury and cold; soaks up and helps to conserve the liquid portion of the manure, and adds humus to the soil when the manure is applied to the land.

### Hard Surfaced Yards

When the cow yards are located on a soil that is soft or has a high water table, yards should be hard surfaced. The hauling of soil that becomes mixed with the manure out on the land leaves deep holes in the yards where moisture collects during the wet season. When these depressions form in a yard and become filled with muck that cows are forced to wade through, it is next to impossible to keep them clean. Where yards are located on level ground that has little or no surface drainage, the ground should be graded before hard



**(Upper) Yard area after the cobbles have been covered. The cement mix was worked between the rocks and trowled down until some of the larger rocks show on the surface. The cement should be left with a rough surface so that the cows will not slip. It took approximately 5 yards of sand, 7 yards of pea gravel and 28 bags of cement to cover 1,260 square feet, or an average of 3.3 bags of cement per 150 square feet. The feed platform to the left is of the same construction and has been in use six years**

**(Circle) Another section of hard surfaced yard showing one type manure retainer at corner of shed to prevent loss of liquid manure draining from the yard and feed manger**

**(Lower) After the loose soil was removed and the proper grade established, cobbles were laid as close together as possible on the area. Most any size of cobble can be used, but those 3 to 6 inches thick are best. The space between the rocks should be tamped full of gravel. This will save the amount of cement required**

surfacing to assure drainage away from the feed racks, water trough, and yard to the most desirable side of the corral, where the liquid portion of the manure can be collected.

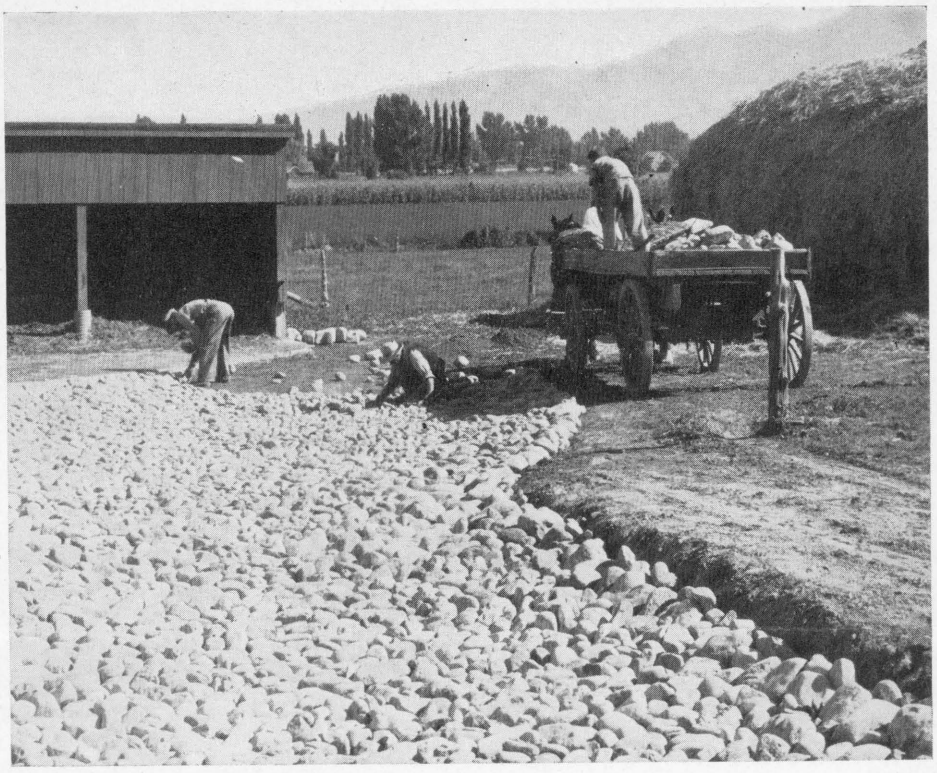
Hard surfacing of feed platforms and yards pays dividends in many ways. There is less possibility of injury or infection to the udder from unclean surroundings. Hard surfacing keeps the cows out of the muck, thus saving time in their preparation for milking; it conserves fertility by preventing leaching of the liquid manure into the ground, and reduces the number of loads of manure that are hauled, because of the fact that when yards are hard surfaced no soil is mixed with the manure. After hard surfacing of the yards at the Dairy Experimental Farm only 2 loads of manure were hauled out as compared to 3 and 3½ loads from the same area before surfacing. The difference indicates the amount of soil that was being hauled away each year.

The area required per cow when the yard is hard surfaced is approximately 150 square feet, providing the yard is cleaned at the proper intervals.

Hard surfacing of the feed platforms and yards with cement can be done in two ways: by using the regular cement mixture run to a thickness of approximately 4 inches, or by using a combination of cobbles covered with cement.

When regular cement is run it will require about 9 bags for each 150 square feet of surface covered 4 inches thick. When cobblestones are used and covered with a mixture of 1 part cement, 3 parts sand and 4 parts pea gravel, 150 square feet of surfacing will require an average of 3½ bags of cement. In many sections of Utah cobblestones are abundant and can be used to advantage.

The total cost of hard surfacing is not great and when completed is an investment that will pay dividends in the saving of labor, the conservation of fertility, and aiding in the production of a milk supply of high quality.



**Five loads of rock hauled on the wagon shown covered 1,260 square feet of surface, enough yard space for 8.4 cows. It required 35 man-hours to haul and lay the rock. Before applying the cement the rocks and ground beneath should be thoroughly soaked with water**

# Bee Losses and Utah Agriculture

## Care in the Use of Sprays and Insecticides Will Materially Lessen Loss of Bees in Utah

By GEORGE F. KNOWLTON

BEEKEEPING and agriculture are inseparably related. Fruits, many vegetable and other seed crops are dependent to a large extent on insects for pollination. Honey bees are one of the chief sources of insect pollination in cultivated gardens and fields.

In 1942, 48,000 colonies of bees in Utah produced 3,000,000 pounds of honey and approximately 60,000 pounds of beeswax, vitally needed in many war processes. The benefits derived by Utah agriculture through increased yield of fruit and seed crops arising from honey bee pollination would exceed by several times the income received for honey and beeswax.

Many adult bees have died in Utah during recent years. Heaviest losses occurred during 1939 and 1943. Arsenic frequently has been the cause of bee mortality. Cooperation of the orchardist, farmer and beekeeper can reduce losses traceable to use of agricultural dust and spray operations.

It was first reported in 1881 that an arsenical spray applied to pear trees in blossom killed many bees. Many entomologists and orchardists since that time have reported serious death loss of bees from hives located near orchard trees sprayed or dusted with poisonous chemicals while in blossom. Thirteen years ago a Utah beekeeper found his bees dead after his neighbor's apple orchard was sprayed while the trees were still in bloom. Many similar cases have occurred. Had the spray been delayed until the petals had fallen, the treatment would have afforded greater codling moth protection and avoided poisoning the bees. There is much reason for delaying the spray application until flower petals have fallen. Prompt removal of the bees to a non-orchard area before spraying occurs would sometimes save heavy bee losses.

Of the agricultural chemicals generally used in Utah, arsenical dusts and sprays are most likely to poison bees. In fact, arsenic was found, usually in dangerous amounts, in many adult bees where serious losses occurred in 1939 and 1943. Some of these losses appear to be traceable to the application of insecticides.

Only 0.05 to 0.5 micrograms of internal arsenic ($As_2O_3$) is necessary to kill a bee, and lesser amounts have bad effects, shortening the productive life of bees.

Bees may obtain poisons other than from crop plant blossoms in sprayed orchards or gardens. Bees foraging for water may pick up arsenic or other poi-

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More detailed information on the subjects discussed here can often be found in Station bulletins and circulars or may be had through correspondence.

College series no. 678


## PROGRAM FOR THE NEW HORTICULTURE EXPERIMENTAL FARM

By R. H. WALKER

INVESTIGATIONS to be initiated at the new Horticulture Experimental Farm will probably center around three general phases of fruit production and orchard management. The first is the testing of improved varieties of stone fruits in an effort to find those best suited to Utah conditions. This will not only involve tests of the fruit varieties themselves, but also of rootstocks and combinations of rootstocks and varieties. Minor tests will also be made of small fruit varieties and of apples, pears and grapes.

The second general phase of the investigations will have to do with orchard soil management practices. In this study an effort will be made to determine a practical method of maintaining the organic matter content and general fertility level of orchard lands. This is important to the fruit growers of the state in their efforts to produce high yields of superior quality fruit.

The third major study will be one of irrigation of orchards on steep lands. Many of the stone fruit orchards of the state are on the steep lands where serious erosion may occur if special attention is not given to irrigation to prevent washing the soil down the slope and the formation of large gullies. This phase of the study is definitely related to the second phase dealing with soil fertility. One of the most satisfactory methods of preventing erosion in an orchard would be to maintain a grass sod cover crop. Yet this may require more irrigation water, and the grass plants may also compete with the fruit crop with a resulting low yield and small fruit of poor color. On the other hand these difficulties may be overcome by a more effective use of irrigation water, combined with the use of commercial fertilizer to improve fruit quality and yield.

As the work on the new farm progresses minor investigations will be made of improved methods of pruning, spraying, thinning, harvesting, packing, grading, and other orchard practices. Attention will also be given to a study of the suitability of fruit varieties for freezing and other processing methods.

Station staff members who will have responsibility of conducting the experiments are: Professor F. M. Coe and Dr. A. L. Stark of the Horticulture Department, Dr. D. W. Thorne of the Agronomy and Soils Department, and Dr. O. W. Israelsen of the Irrigation and Drainage Department. These men will be assisted by Dr. George F. Knowlton and Professor C. J. Sorenson in the study of insect problems and also by Dr. B. L. Richards and Dr. F. B. Wann in the study of diseases of fruits. Mr. J. B. Brown is living on the farm and will have supervision of the general field work.

At the last meeting of the State Horticultural Society, the president of the society was authorized to appoint a special research advisory committee to advise with the Station project leaders in the development of their research program. These men will be especially helpful in bringing the practical problems of the fruit growers of the state to the attention of the Station workers and also in helping to plan the operations in conducting the investigations.

The new experimental farm is located in the northern part of Weber County in the Pleasant View community. There are slightly over 71 acres of land, most of which lies immediately below the high line canal from the Pineview reservoir. Ample irrigation water is available, and the site and elevation are ideal to afford a maximum of frost protection. The soil on the upper part of the farm is slightly gravelly and typical stone fruit land, whereas that on the lower portion is a heavy loam to silt loam suitable for apples, cherries and berries. This variety of soil is highly desirable for experimental purposes.

When the farm was purchased the upper portion was rather rough, making efficient irrigation practically impossible. Furthermore there were three or four extremely bad gullies which had developed through flood damage and as a result of difficulties involved in controlling irrigation water on the prevailing steep slopes. It was decided at the outset that the gullies would need to be filled in and the land graded to as nearly a uniform slope as possible in order to permit effective irrigation and at the same time prevent erosion of the soil. Consequently an agreement was entered into by the Soil Conservation Service and the Extension Service with the Agricultural Experiment Station for the purpose of conducting a demonstration on soil conservation on steep orchard lands. The Soil Conservation Service generously furnished a large caterpillar tractor and land leveling equipment and an engineer to supervise the field work.

In addition to grading the land and filling in gullies some natural springs have been capped and tile lines laid to direct the flow of the spring water to a reservoir that was built for storage of water some years ago. The next step in this part of the program is to develop a suitable irrigation system which will permit the efficient distribution of water without loss and without erosion.

## The Authors

Fertilizers available to farmers this year are to be apportioned to the various crops according to federal regulations in amounts recommended by the agricultural experiment station. These recommendations for Utah were prepared by **Dr. D. W. Thorne** and **Dr. H. B. Peterson** of the Department of Agronomy and Soils after discussion with a station committee. They were published in the Utah Farmer. The article written by them in this issue advises farmers about how they can make the best use of the fertilizers available.

**Dr. D. E. Madsen,** head of the Department of Veterinary Science, has charge of the Veterinary Laboratory at Logan.

**George Q. Bateman** is a crusader for better methods in dairy production in Utah. His special interests are more and better pastures, supplemental feeding of grain to high producing cows, and improvement of dairy stock through breeding programs. He is superintendent of the Dairy Experimental Farm and works cooperatively with the U. S. Bureau of Dairy Industry. He is one of the best amateur photographers at the college.

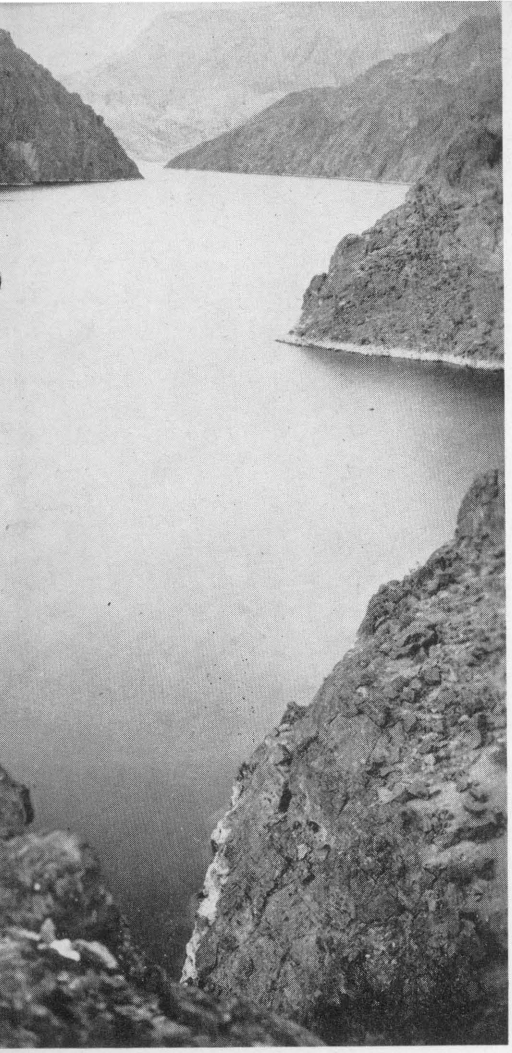
**Dr. George F. Knowlton,** research associate professor of entomology, is spending a large part of his time attempting to find the causes for the serious bee losses that have been prevalent in the state the past few years.

In the fourth article on the Wasatch Front study, **Dr. O. W. Israelsen,** associate research professor of irrigation and drainage, discusses the need for additional water storage facilities in this area.

As senior ecologist at the Intermountain Forest and Range Experiment Station of the U. S. Forest Service at Ogden, **Dr. George Stewart** supervises much of the research on the Desert Experimental Range. He was formerly head of the Department of Agronomy and Soils at Utah State. **Mr. Hutchings** is in direct charge of the Desert Station.

**Professor Francis M. Coe,** head of the Department of Horticulture, has been a member of the Station staff since 1927. He is in charge of the variety and rootstock investigations.

# WASATCH FRONT IRRIGATION RESOURCES



**Great man-made lakes like Lake Mead on the Colorado River shown above are needed to store all of the Bear River flood waters for use on Utah lands**

*THIS is the fourth of a series of articles reporting findings on the opportunities for development and stabilization of agriculture in the Wasatch Front area of Utah during the war and postwar periods. Other phases of this study will be published in future issues of "Farm and Home Science."*

*The agricultural study is one part of a larger study which includes chapters on industrial development, water and power, transportation, recreation and rehabilitation, public works, and community planning. The study was published by the Utah State Department of Publicity and Industrial Development.*

By O. W. ISRAELSEN

### Irrigation Water Supplies

WATER supplies for irrigation and other uses are obtained from natural stream flow during the season of diversion and use, surface reservoir water storage, and ground-water storage. It is convenient to divide the Wasatch Front area into three subdivisions, the Jordan River-Utah Lake Area, the Ogden and Weber River area, and the lower Bear River drainage area.

### Jordan River-Utah Lake Area

The major creeks and rivers that provide water for the Jordan River-Utah Lake drainage area designated from north to south are as follows: City, Emigration, Parley's, Mill, Big Cottonwood, and Little Cottonwood Creeks in Salt Lake County; and American Fork Creek, Provo River, Hobble Creek, and Spanish Fork River and Payson Creek in Utah County.

### Direct Stream Flow Appropriated

The direct stream flow during the summer and fall irrigation season on all of the rivers in the Jordan River-Utah Lake drainage area was fully appropriated many years ago. Several storage reservoirs have been completed and a substantial percentage of the flood waters appropriated and stored for irrigation, city water supplies, and industrial uses. Additional storage of water in surface reservoirs to the fullest extent practical, and in underground reservoirs, for use in this area is of vital importance to Utah's future.

### Storage in Surface Reservoirs

Among the more important reservoirs on these streams, again listing from north to south, are: Mountain Dell on Parley's Creek, having a capacity of 3,514 acre-feet; Deer Creek on Provo River, capacity of 152,500 acre-feet; Strawberry Reservoir in the Colorado River drainage area from which water is diverted through a tunnel to the Spanish Fork River, capacity of 278,000 acre-feet; and the Utah Lake Reservoir, capacity of 850,000 acre-feet. Some water for Utah County is obtained from storage in Echo Reservoir on Weber River through exchange agreement and diversion of water across the Kamas Bench into Provo River.

### More Utah Lake Storage Needed

The most noteworthy seasonal variation is in Utah Lake storage reservoir. This, of course, must be expected when storage capacity is large in relation to average stream flow. From 1921 to 1933 the inflow to this reservoir ranged from 1,000,000 acre-feet to 384,000 acre-feet, with an average of 623,000. It is estimated that during the same period the average annual evaporation loss was 330,000 acre-feet.

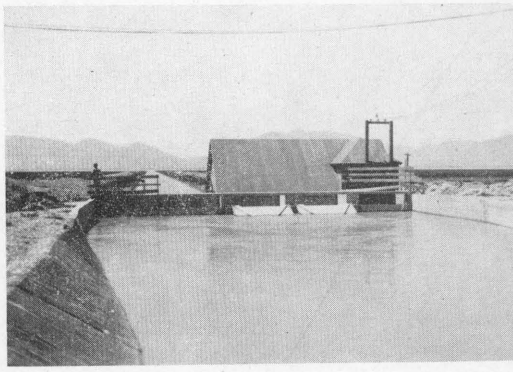
The total annual diversions from Utah Lake and Jordan River during the period from 1921 to 1942, as shown in table 1, ranged from a maximum of 627,000 acre-feet in 1922 to a minimum of 72,000 acre-feet in 1935.

The yield of the lake during the dry years of 1933 to 1936 was inadequate for the needs of Salt Lake County irrigated lands. In 1934 and 1935 the water shortage was serious. In order to meet the emergency demands for more irrigation water for Salt Lake County lands a large pumping plant was installed at Pelican Point and a stream of nearly 300 second feet was pumped from Utah Lake as shown in the figure.

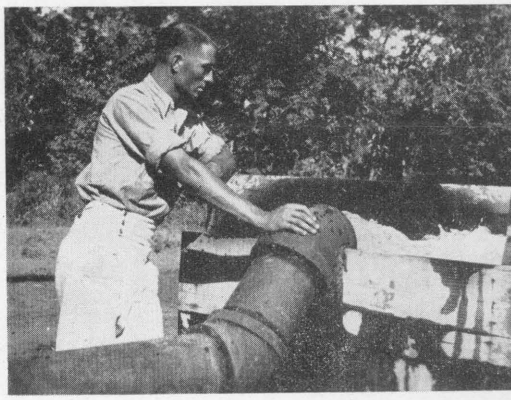
Evaporation losses from Utah Lake are high. The annual irrigation water yield can be greatly increased by construction of a dike to reduce the lake area. This is an appropriate and much-needed project.

*(Continued on page 10)*

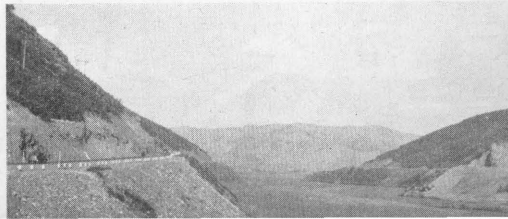
**The storage capacity of Utah Lake is increased by pumping water from the lake with large plants like this one at Pelican Point**

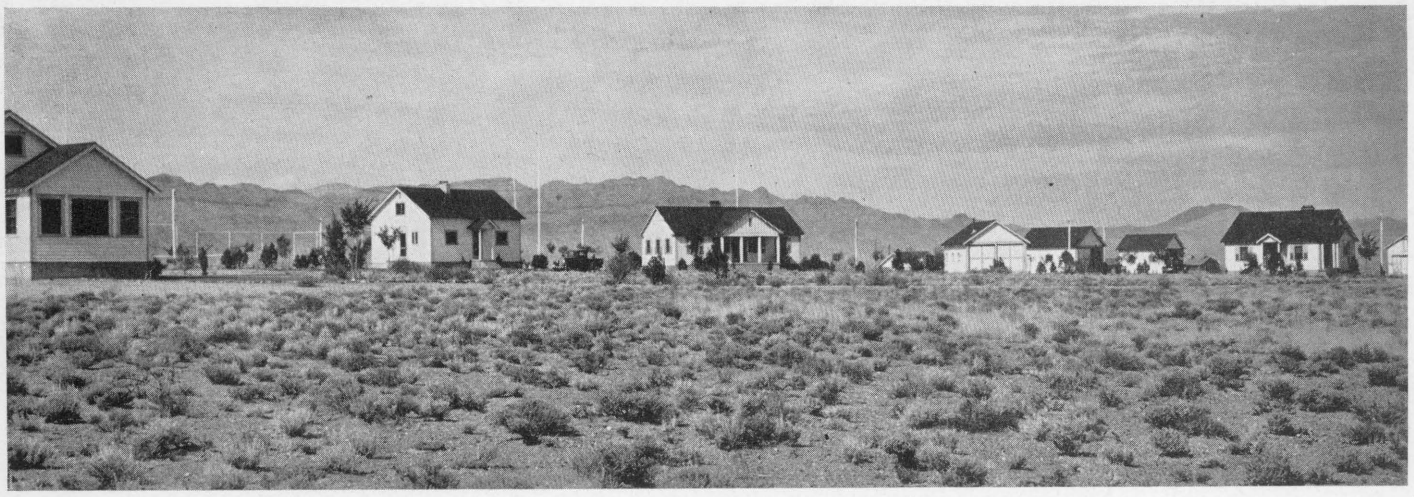


**The water obtained from wells like this provided for serious emergency needs of Salt Lake City during the critically dry year of 1934**



**Conservation and use by Utah's people of the 460,000 acre-feet of water that Weber River annually wastes into Great Salt Lake can be achieved by the enlargement of this reservoir and construction of others like it**





**General view of headquarters buildings at the Desert Experimental Range, Millard County, Utah, and 50 miles northwest of Milford**
(U. S. Forest Service photo 332229)

# Winter-Range Research at the Desert Branch Experimental Range

By GEORGE STEWART and SELAR S. HUTCHINGS

**Intermountain Forest and Range Experiment Station**

ABOUT 50 miles west of Milford, Utah, just north of the Milford-Ely highway is the Desert Branch Experimental Range operated by the Intermountain Forest and Range Experiment Station, U. S. Forest Service, Ogden, Utah. This research project, in the southwestern corner of Millard County, is located in the heart of the winter ranges which lie in western Utah and eastern Nevada. It consists of 55,000 acres of desert winter range divided into 20 pastures of either 240 or 320 acres in size and four large range allotments on which winter bands of sheep graze experimentally. To facilitate the conduct of the experiment approximately 120 miles of boundary and division fences have been constructed, a deep well dug and equipped for pumping into a 40,000-gallon reservoir and the necessary buildings erected and roads opened.

The area represents rather similar range conditions in eastern and western Utah, southern and central Nevada, southwestern Wyoming, southern Idaho, and eastern Oregon. There are 41 million acres of salt desert shrub and another 10 to 12 million that is closely similar, in that it bears an appreciable percentage of salt-desert shrub in the plant composition. The plant cover on nearly all the salt-desert shrub range has seriously deteriorated as a result of 30 to 60 years of grazing that in early days was largely uncontrolled. The deterioration consisted largely of loss in production by the more valuable forage species, owing in part to weakened plants, in part to dead plants, and in part to the valuable species having been replaced by other species of low value. Reproduction was also greatly retarded, and, in the worst cases, largely prevented as a combined result of the poor seed crops that were obtained from weakened plants and the injury suffered by seedlings from heavy and untimely grazing.

The desert shrub vegetation on the station typifies approximately 80 percent of Utah's winter range lands, the other 20 percent consisting of sagebrush (about 10 percent), blackbrush (5 percent), and miscellaneous vegetation (5 percent). The precipitation during the 10 years of the station's life has varied from 2.6 inches in 1942 to 9.79 inches in 1938 and averaged 6.2 inches for the period. Most of the soils are loose, sandy loam or gravelly, sandy loams, though considerable areas are rough and rocky. Most of the valley soils bear considerable salts in the subsoils. Altogether the forage production is small on an acre basis. More than 2 million sheep and around 100,000 cattle gather their feed for 4 to 6 months in winter from the sparse vegetation produced under these conditions.

### Program of Research at Desert Station

Because these ranges had been deteriorating under severe use for a number of years before 1933 when the station was established, it was planned to experiment with grazing use in such a way as to find out if possible how to restore their producing ability. About a dozen 4-acre enclosures located at critical points as to kind and condition of vegetation are used to compare forage production under complete protection with that on areas that are moderately grazed under good management and that on heavily grazed areas largely without management.

For the purpose of study the 6-month winter period was arbitrarily divided into three periods of 2 months each and designated as fall (November and December), winter (January and February), and spring (March and April). Of the 20 pastures, 18 are grazed in six seasonal treatments each at three intensities of forage utilization as follows:

**Light utilization**

| | |
|---|---|
| Fall only | Fall and winter |
| Winter only | Fall and spring |
| Spring only | Winter and spring |

**Moderate utilization**

| | |
|---|---|
| Fall only | Fall and winter |
| Winter only | Fall and spring |
| Spring only | Winter and spring |

**Heavy utilization**

| | |
|---|---|
| Fall only | Fall and winter |
| Winter only | Fall and spring |
| Spring only | Winter and spring |

The two remaining pastures are grazed during the winter, one at heavy intensity which approximates grazing on the majority of the winter range in the vicinity of the Desert Experimental Range, and the other is utilized at a moderate intensity which permits the plants to remain in vigorous condition. These two pastures serve as a standard

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In the reference citations the first number refers to volume, the second to number and the third to page. For example, 2(3)2 is volume 2 number 3 and page 2, or page 2 of the September issue of 1941.

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useful in equating the grazing on the experimental area with that on the adjacent ranges.

Grazing treatments were assigned to the pastures at random and are so arranged as to permit statistical analysis regarding effects of the treatment on both forage production and animal responses. The 20 fenced pastures were grazed by small bands of sheep varying from about 20 to 165 in number.

The four grazing allotments each consist of areas from 6 to 24 sections of land and are grazed by the herds (2,000 to 3,000-sheep) owned by cooperating stockmen who graze according to a plan previously agreed on, and supervised by the technician in charge of the work at the station. The time of grazing and the manner of handling the sheep are carefully outlined in the plan. One grazing allotment and the pastures are grazed in alternate years by sheep belonging to George C. Jackson and in the other alternate years by sheep owned by his brothers, Willie and Alvin Jackson. When not on the experimental range these sheep graze on their own Grazing Service allotment a few miles to the south. Walter James, Fountain Green Woolgrowers, and the Fairview Coop. have grazed the other herd allotments according to the plan provided for each one.

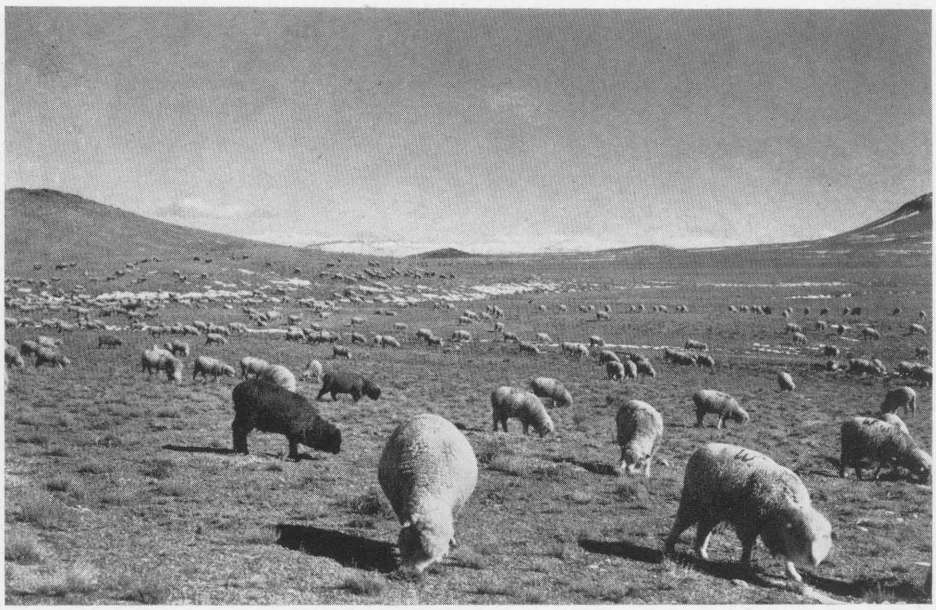
Records are kept of the responses of vegetation and of the sheep to the various grazing treatments and systems of management. The vegetation records consist of the yield of individual plants, of the acre-yield of total forage, of the establishment of young plants, of the quality of the forage, of the changes in species composition, and of the trend in range condition. For animals records are made of wool yield, the percentage lamb crop, the body weight of ewes, the percentage death losses, the amount of supplemental feeds required, the management difficulties, and the income obtained.

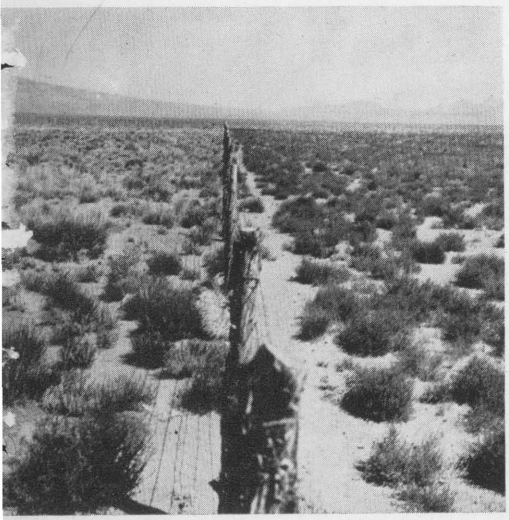
For comparison, similar though less complete records are kept of the management, movement, and production of two to four herds of sheep which graze on outside range. Providing water to experimental herds in periods when no snow is available for stock water has also been under study for several years as well as the movements of sheep to the winter ranges and back to the spring lambing ranges. The effects of local sheep movements on the range to and from water or to and from snow drifts in the mountains have also been carefully observed.

### Progress Report of Experimental Findings

Although experiments at the Desert Station are still in progress and will need to be continued for sometime before the studies are complete, some highly important findings are already manifest and available to stockmen, which it is hoped they will use in man-

**Sheep grazing on the Desert Experimental Range. The vegetation is short but very palatable and nutritious, consisting of black sage, winterfat, and Indian ricegrass. The sheep are quiet, contented and grazing in open herd formation** (U. S. Forest Service photo 410197)

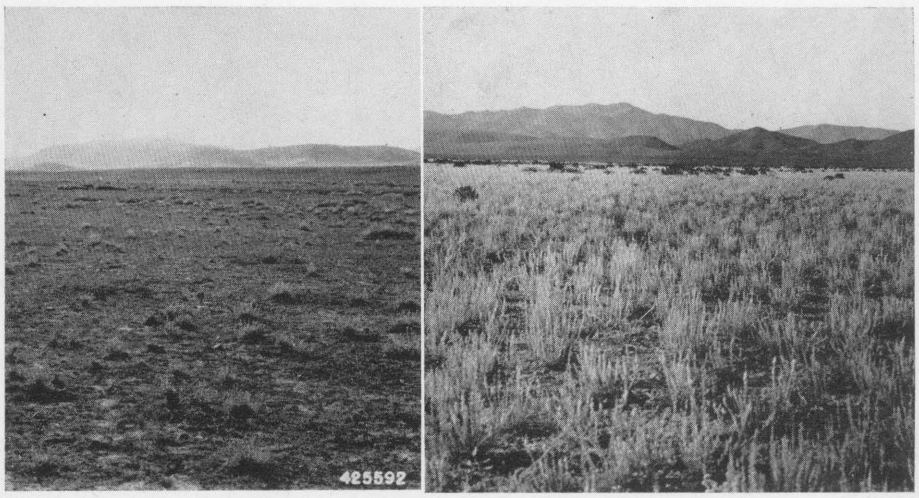




**Above—(Left) Inside Experimental Range fence. The light-colored vegetation is high-value perennial forages such as winterfat and curly grass. (Right) Open range grazed severely and grown up to Russian-thistle, a low-value forage species** (U. S. Forest Service photo 410071)

**(Below, left) Winterfat plant association in Wah Wah Valley on which the plants have been greatly weakened by heavy unmanaged grazing. The stubs show the location of winterfat plants that have been killed, or nearly so** (U. S. Forest Service photo 425592)

**(Below, right) Winterfat in a vigorous condition. The area at the left should look almost the same as this one** (U. S. Forest Service photo 275556)



aging their own herds. Among the more important of the valuable pieces of information obtained to the present are:

A. Vegetation and Soil

1. Range vegetation that has been moderately grazed under good management has increased in vigor at about the same rate as that not grazed at all. It is possible, therefore, to improve the range while it is being used, if the livestock numbers are kept at such a level as to provide for moderate utilization of the forage. In most cases the level of numbers may later be increased.

2. The yields of individual plants of the three most valuable forage species, Indian ricegrass **(Oryzopsis hymenoides),** winterfat **(Eurotia lanata)**, and black sagebrush **(Artemisia nova),** were increased in 4 or 5 years from two to two and one-half times as a result of moderate grazing and good management.

3. Good management also greatly increased the seed crop as a result of increased plant vigor. The establishment of young plants of desirable forage species occurred on the properly managed areas as a combined result of the better seed crop and the smaller disturbance of the seedlings.

4. The total forage yield (higher yield per plant plus yield of new plants) in 6 or 7 years was increased from two to three times on the moderately grazed well-managed areas.

5. The three most valuable forage species increased at the expense of low-value species, crowding out almost entirely the low-value annual, Russian-thistle, and reducing markedly the unpalatable perennial, desert rabbitbrush. Russian-thistle varied greatly in production from year to year, but even in the most favorable years the three most palatable forages practically eliminated it on properly used range until it looked as if in properly handled pastures the Russian-thistle had been removed by hand.

6. Soil conditions on the basis of observation were greatly improved on well-managed range because the better plant cover reduced erosion by both wind and water.

B. Livestock and Income

7. Over a period of 7 years during which it was measured, the average wool yield was about one pound greater for sheep kept on range that has been moderately used and well managed than for sheep grazed on heavily used range during the same years.

8. Lamb crops from ewes grazed on well-managed range were from 5 to 8 percent greater, even though the lambs were born 1 to 2 months later on the spring range 100 to 200 miles away.

9. Body weights of ewes in spring averaged 8.4 pounds higher for sheep grazed on moderately used well-managed range.

10. Death losses have been lowered 5 to 10 percent on well-managed range, practically eliminating losses caused by malnutrition.

11. Supplemental feeding was entirely unnecessary for sheep on the well-managed station range but was required for various bands on outside range in 3, 4, or 5 out of the last 10 years, depending on the relative condition of the particular range they used and how the sheep were handled.

12. Management difficulties and expenses were less on well-managed range and the profits greater by about $1.00 per ewe.

13. Records of wool production by individual sheep showed that the ewes which were low producers as yearlings continued to be low producers as 2-year-olds and 3-year-olds, and presumably in later years.

There is no trick connected with these important responses obtained on the Desert Station Experimental Range. Any stockman, or at least, any group of stockmen may obtain similar results by practicing good management consistently for a period of years. The principal parts of good management as here used consist of moderate utilization of the forage; open, quiet herding so as to prevent sheep from becoming startled; elimination of trailing by bedding down the sheep wherever they happen to be at night and by hauling water when that is necessary; watering the sheep at short intervals, usually every day and never less often than every 2 days; and using range at the season of the year for which it is suited. Additional production in forage and sheep would most likely be obtained by hauling sheep to and from the winter range thus eliminating the long trek. Whether the cost would be too great to justify this yet remains to be determined. Great gains would, however, most likely be obtained at small cost by intelligently culling out the low wool producers at the first shearing, as nearly all low producers as yearlings remain so for the next several years.

## FERTILIZERS

*(Continued from page 1)*

### Estimating Soil Needs

The first appraisal to be made in planning a fertilizer program should be of the soil. Some soils contain ample quantities of plant nutrients. Some are well supplied with all essential nutrients except one, others may be deficient in several elements. The fertilizer problem in Utah is confined principally, however, to nitrogen and phosphorus. Soils most likely to be deficient in nitrogen include those that are light in color, sandy or gravelly in texture, and which have not been recently plowed out of a perennial legume or treated with farm manure.

Soils which frequently lack sufficient available phosphorus for maximum growth of many crops include those light in color, heavy loam or clay in texture, those containing large amounts of lime, and those that have not been recently phosphated and have produced crops of alfalfa or sugar beets.

Crops also vary in their fertilizer requirement but before making recommendations for the various crops a few statements should be made on methods of fertilizer application.

### Methods and Time of Application

Most farmers in Utah do not have fertilizer distributing equipment. The general practice has been to apply the fertilizer broadcast on top of the soil and to work it into the seedbed. Numerous experiments have shown such broadcasting methods to be wasteful of fertilizer for most row crops. It has been found that if the fertilizer is placed in a band a short distance from the seed comparable increases in crop yields may be obtained with half the quantity used in broadcast applications. Wherever machinery is available row crops should receive banded fertilizer applications.

Another type of fertilizer distribution that has given good results with phosphate is a fertilizer plow attachment which drops a band of fertilizer in the bottom of each plow furrow. This method is particularly applicable to broadcast crops and may also be of value on many row crops. In addition, many farmers or local machinists have built satisfactory fertilizer distributors.

Most fertilizer applications should be made at seeding time or applied as side dressings during the growing season. Nitrogen fertilizer applied in the fall or winter will often leach out of the soil before crops are ready to use it. Phosphate fertilizers gradually react with soil

and are rendered insoluble. Hence they should also be applied as nearly as possible to the time they will be used by the plant.

### Fertilizing the Rotation

It is usually not profitable to fertilize every crop in a rotation. In a balanced soil management program fertilizer applications are spaced to bring maximum results. Alfalfa and clover crops build up reserves of organic matter and nitrogen in soil. Consequently, the fertilizer needs of crops planted on land plowed out of such legumes would be somewhat similar to the same crop on manured land.

The benefits of phosphate fertilizer frequently last three or four years. Crops which respond well to phosphate fertilizer include alfalfa, clover, mixed pasture, sugar beets, and to a somewhat lesser degree—tomatoes and peas. It is usually best to apply phosphate to crops which respond best to it and to follow this crop with a crop having a lower phosphate requirement. Thus, land plowed out of alfalfa which had been recently phosphated and planted to potatoes or corn would not usually need additional fertilizer.

### Fertilizer Suggestions for Various Crops

Fertilizer should not be used extensively unless field trials on each farm demonstrate that such a practice is profitable. If fertilizer is known to increase crop growth attention should be directed toward getting the most benefit out of the fertilizer used. The following notes on fertilizer practices applicable to some of the more important Utah crops may be helpful:

| Crop | General commercial fertilizer practice |
|---|---|
| Alfalfa and clovers | **New plantings:** Apply phosphate fertilizer with plow attachment, or broadcast on seedbed and harrow into soil just before planting. **Old stands:** Apply fertilizer broadcast on soil in early spring and harrow into soil or drill into soil with a grain drill having a fertilizer attachment. Use 150-200 lbs. concentrated superphosphate or 300 to 400 lbs. of the 20 percent grade per acre. |
| Beans, dried and snap<br>Cabbage<br>Carrots<br>Lettuce<br>Onions<br>Sweet corn<br>Potatoes<br>Wide spaced celery<br>Tomatoes | It is generally preferable to apply the fertilizer with an attachment to the planter at seeding time, or side dress the plants about time of the second cultivation. If equipment is not available, broadcast fertilizer and harrow into seedbed just before planting. Use 100 to 250 lbs. of a 6-30-0 fertilizer on land not manured, or 75 to 150 lbs. of treble superphosphate on manured land depending on the method of application. For sweet corn 200 lbs. of a 10-20-0 fertilizer may be used on unmanured land. |
| Peas | Broadcast fertilizer and harrow into seedbed just before planting or apply with plow attachment. Use about 150 lbs. of treble superphosphate. |
| Close spaced celery | Apply first application of 200 lbs. of 10-20-0 fertilizer on unmanured land, or 200 lbs. of treble superphosphate on manured land, and harrow into seedbed just before planting. Side dress with ammonium sulfate, 100 lbs. per acre three different times at two week intervals, beginning about August 1 in northern Utah. A hand pushed drill such as a Planit Junior can be used if larger equipment is not available. |
| Sugar beets | Apply phosphate fertilizer with attachment on drill at planting time. If the drill drops the fertilizer with the seed a fertilizer containing nitrogen should not be used and treble superphosphate applications should be kept below 80 lbs. per acre. If land is poor and manure has not been applied, or beets have light color, side dress with 100 lbs. of ammonium sulfate per acre about time of the first irrigation or before. Phosphate fertilizer may be broadcast on the seedbed at a rate of 150 to 200 lbs. per acre if preferred. |
| Sugar beet seed | Apply 150 to 200 lbs. of treble superphosphate by broadcasting and harrowing into seedbed just before planting. Fifty pounds of this may be drilled with the seed. Apply 100 lbs. of ammonium sulfate as a side dressing in fall as soon as beets are large enough, and apply 100 to 300 lbs. as a side dressing in the spring. Less nitrogen need be used where land is manured. More nitrogen is usually needed for beet seed production in Washington County than in other parts of the state. |
| Vegetable seed<br>Annual: | Apply broadcast and harrow into seedbed, or drill to side of row at planting. On poor, unmanured land 150 to 300 lbs. of a 10-20-0 fertilizer is suggested. For good land 100 to 200 lbs. treble superphosphate fertilizer will suffice. |
| Perennial: | Apply 200 lbs. of phosphate to manured land in fall before seeding. Side dress with 100 lbs. of ammonium sulfate in spring. If manure is not available, apply 200 lbs. of 10-20-0 in fall to seedbed and side dress with 100 lbs. of 10-20-0 or of ammonium sulfate the following spring. |
| Irrigated pasture | **New plantings:** Apply 200 lbs. of treble superphosphate broadcast and harrow into seedbed just before planting. **Old pastures:** Apply phosphate broadcast in early spring (200 lbs. per acre every third or fourth year is usually sufficient). To encourage early grass growth, apply 200 lbs. of ammonium sulfate broadcast in early spring. Nitrogen fertilizer applications in midsummer will improve late pastures. Manure applied in early spring benefits grass throughout the summer. |
| Fruit trees | Apply fertilizer at early blossom stage by broadcasting and disking into soil or drilling in bands between rows. Fertilizer equal to 3 lbs. of ammonium sulfate per tree is recommended for mature, bearing peach, apricot, pear, plum and sour cherry trees. Mature, bearing apple and sweet cherry trees may need up to 5 lbs. of ammonium sulfate per tree. Where liberal amounts of farm manure are used no commercial nitrogen fertilizers may be needed. |

## CONFERENCE OF IRRIGATION WORKERS IN EXPERIMENT STATIONS IN THE WESTERN REGION HELD IN LOGAN

**Irrigation workers of the western states met in Logan, January 20-21, 1944, to discuss a coordinated regional program of research in irrigation and drainage. Representatives from all the western states attended, also Regional Coordinator Clyde McKee, director of the Montana Station and Dr. R. H. Walker, director of the Utah Station. The Utah Station was represented at the conference by Dean G. D. Clyde and Dr. O. W. Israelsen.**

**Representatives presented reports on irrigation research already underway at the various stations and on their immediate and future problems. Following this the group discussed and developed a program of future irrigation research divided into six major topics: soil and irrigation relationships; plant and irrigation relationships; irrigation water supply and its physical control; drainage and reclamation of waterlogged, alkali and overflow lands; irrigation and drainage relationships; and economic and social aspects of irrigation agriculture.**

**Recommendations for the development of this program were passed and will be submitted to the directors of the western stations for approval.**

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**Dr. Fred McKenzie, head of the Animal Husbandry Department of the Station, resigned January 1 to take a position as head of the research division of the Superior Products Company of Golden, Colorado.**

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**Superphosphate has been shipped in the state recently. This is a good fertilizer but is only about half as strong as treble superphosphate. For best results two bags should be used where one of treble superphosphate has been the practice.**

## IRRIGATION RESOURCES

*(Continued from page 1)*

### Storage in Underground Reservoirs Feasible

The U. S. Geological Survey has recently made a comprehensive study of ground water in the Jordan Valley. The report of these studies released in February, 1943, states that there are 5,500 privately owned wells in Jordan Valley. One 7-square-mile area has 1,000 flowing wells. As in other valleys, ground water is discharged by flow of springs, evaporation and transpiration, flow of artesian wells, and by pumping from wells. It is estimated that 200 cubic feet per second is discharged from Jordan Valley artesian aquifers through artesian wells. Detailed study was made of 1,138 wells ranging in depth from 40 to 1,468 feet and having an average of 222 feet. Water measurements from 776 of these wells, most of which are two inches in diameter, average 19 gallons per minute or 0.042 second-feet per well, enough to provide full water supply for more than 3,000 acres. Special note is made of the 14 emergency wells drilled by Salt Lake City during the dry year of 1934, which yielded a total flow of 46 second-feet—an average of 3.3 second-feet per well. One of these wells, with a drawdown of 40 feet, yielded a flow of 10 second-feet. The wells, one of which is shown in the figure, ranged in diameter from 12 inches to 20 inches. The available ground water in 1934 enabled Salt Lake City to meet the water requirements of its citizens and provide reasonable fire protection under emergency conditions.

In the studies of the U. S. Geological Survey attention was given to annual fluctuations in ground-water levels, and it was found that the most marked changes were in the recharge area near the mountains. Water levels were substantially constant near the center of the valley northwest of Salt Lake City.

It is concluded from these investigations that, if supported by intelligent public opinion, there are opportunities for development and extended use of ground water in the Jordan Valley. Although the actual volume of ground water used for irrigation is not known, it is apparent that a yield of 200 second-feet would provide 60,000 acre-feet in a 5-month period—enough for a full water supply for 20,000 acres of the lower valley land.

Substantial development of ground water in Jordan Valley by pumping for irrigation would lower the artesian pressures and the flow from many small wells, and thus necessitate a development of replacement water supplies. In order to make such replacements successfully, they must be not only physically and economically feasible, but also approved by the owners of the small flowing wells to prevent ruinous litigation costs.

**Table 1. Annual diversions from Utah Lake and Jordan River and annual water flow into Great Salt Lake from Weber River and Bear River**

| Year | Utah Lake yields | Weber River contributions to Great Salt Lake | Bear River contributions to Great Salt Lake |
|---|---|---|---|
| | | *thousands of acre-feet* | |
| 1918 | ..... | 413 | 1155 |
| 1919 | ..... | 342 | 944 |
| 1920 | ..... | 781 | 1307 |
| 1921 | 459 | 1075 | 1778 |
| 1922 | 627 | 928 | 2024 |
| 1923 | 576 | 875 | 1860 |
| 1924 | 536 | 363 | 1084 |
| 1925 | 293 | 495 | 1079 |
| 1926 | 267 | 382 | 882 |
| 1927 | 261 | 584 | 1042 |
| 1928 | 286 | 504 | 886 |
| 1929 | 261 | 611 | 902 |
| 1930 | 270 | 277 | 653 |
| 1931 | 199 | 112 | 360 |
| 1932 | 177 | 568 | 817 |
| 1933 | 141 | 370 | 622 |
| 1934 | 93 | 61 | 300 |
| 1935 | 72 | 226 | 446 |
| 1936 | 150 | 634 | 898 |
| 1937 | ..... | 473 | 683 |
| 1938 | 212 | 448 | 572 |
| 1939 | 220 | 214 | 572 |
| 1940 | 200 | 164 | 453 |
| 1941 | 172 | 172 | 368 |
| 1942 | 215 | ..... | ..... |
| Average | 271 | 461 | 904 |

### Weber River Contributions to Great Salt Lake

Water which flows into Great Salt Lake has no value for irrigation. There are wide variations in annual water contributions of Weber River to the lake, the average for a 24-year period, 1918 to 1941, inclusive, being 463,000 acre-feet (table 1). This is enough water to cover all of the irrigated lands in the Weber River system annually to a depth of more than one foot, and almost enough to fill 10 reservoirs like the Pineview shown in the figure. During 8 years of the 24 the loss was more than 500,000 acre-feet; during 6 years it exceeded 600,000 acre-feet; during 4 years it was more than 700,000; and in 3 years it was more than 800,000 acre-feet. The maximum loss which occurred during the 24-year period exceeded one million acre-feet and occurred during 1921. In examining table 1 it should be noted that during recent years water-tight dams were placed in the river below Plain City to divert all of the natural stream flow during summer months for use in migratory bird refuges during the months July to October. Deducting the flow during these months would still leave an average annual waste of 446,000 acre-feet.

The need for reservoir storage capacity, somewhat greater than the average discharge of 463,000 acre-feet, in order to conserve at least some of the waters of years of heavy runoff like 1920 and 1927 to 1929, is clearly seen in table 1.

### Bear River Contributions to Great Salt Lake

The yearly water contributions of Bear River to Salt Lake during the 24-year period 1918 to 1941 are shown in table 1. The average annual flow from Bear River into Great Salt Lake is 903,000 acre-feet; the minimum annual flow was 300,000 acre-feet in 1934, and the maximum was 2,024,000 acre-feet in 1922.

During 9 of the 24 years, the contribution was above the average, and it was about 1,000,000 acre-feet for 8 years, and above 1,200,000 acre-feet during 4 years.

The waste into the lake was less than 500,000 acre-feet during only 5 years of the 24 and less than 700,000 acre-feet, or roughly less than three-fourths of

the average, during 10 years of the 24.

More reservoirs of large capacity like the one shown in the figure are needed to store the waters of Bear River that are wasted into Great Salt Lake.

The water supply data of table 1 show that Bear River, if fully stored, will provide water for a considerable area of arable land not yet irrigated. Full information concerning the location, quality, and area of non-irrigated arable land in Box Elder County is not yet available. It is however noteworthy that the Bear River water contribution to Salt Lake in the driest year of record (1934) would have provided nearly 6 acre-feet per acre for the 55,000 acres that might be brought under cultivation.

●

## BEE LOSSES

*(Continued from page 3)*

son in drops of spray, in dew or condensed moisture on sprayed or dusted foliage of trees or orchard cover crops. Poison can be picked up from alfalfa, sweet clover, weeds in blossom or from pollen-producing grasses. Cutting of attractive undercover by mowing or clean cultivation before spraying will greatly reduce this hazard. Besides the danger of immediate poisoning from liquid chemicals, toxic dusts or dried poison from spray may be taken up with pollen occurring on plants on which insecticides have fallen or drifted. Such dry particles may be stored in the hive, later killing nurse bees and brood. Many of the bee yards in Utah, examined following losses of adult bees during 1943, revealed dangerous amounts of arsenic present in hive pollen. Such hives dwindled during the season, many colonies dying out or becoming so weak as to be unable to survive the winter.

Use of calcium arsenate and certain other dusts has increased the danger to bees. Fortunately for the Utah bee industry airplane dusting is not practiced in this state. Dusting of clean tomato fields by hand or powered ground equipment seems to cause little risk to bees if the dust is applied when the air is calm. If applied in a wind, it may be blown onto fence row sweet clover or nearby fields of blossoming alfalfa. If applied to a field in which weeds producing nectar or pollen attractive to bees are present, the arsenical dust will be collected with pollen and carried to the hive, resulting in death of bees. Care in applying dusts while the air is as quiet as possible, and in having fields and gardens free from attractive weeds at time of treatment are two ways that farmers can aid the beekeeper. These practices also improve insect and disease control. If large scale spraying or dusting operations are to occur in an area, it is well to notify beekeepers so that they may move their bees if they so desire. Although it is expensive to move bees the survival of the colonies will sometimes justify temporary moving to a less productive but safer location. This should be at least 3 or 4 miles away.

California beekeepers and melon growers found that bee losses could largely be eliminated when melons were dusted for aphid control while blossoms were closed. This necessitated dusting before 6 a.m. or after 4 p.m. Squash blossoms closed earlier and could be safely dusted after 1 p.m.

Arsenic collected on the legs of bees with pollen, and stored in the hive, remains poisonous for years. In several areas of Utah during 1943 nurse bees, evidently killed by arsenic in stored pollen, crawled outside and died near bee hives. Analyses of the pollen and dead bees often showed dangerous amounts of arsenic. During 1942 large numbers of bees died in Salt Lake County, or went into the winter in a weakened condition. Pollen samples taken from affected hives in the spring of 1943 usually showed injurious amounts of arsenic. A similar situation occurred in Salt Lake and Davis County bee yards during 1943. Pollen combs can be freed from arsenic by soaking in water for 48 hours, after which the pollen shrinks and can be removed by the bees. Dusts such as pyrethrum, rotenone and nicotine soon lose their toxicity after application and within a few hours or days they are no longer sources of danger to bees.

Bees swarm into blossoming asparagus patches in great abundance. The cooperation the asparagus growers can give the beekeeper is to delay late summer spray treatment for asparagus beetle until the asparagus blossoms are gone and the bees have stopped frequenting the patch.

Most Utah beekeepers now agree that properly flaked-out bait, if scattered according to recommendations, is not dangerous to bees. For the safety of bees, livestock, wild life and persons, however, care should be used in handling, sorting and spreading grasshopper bait, just as with all other poisonous substances. Most of the bait used in Utah during 1943 was prepared with sodium fluosilicate as the killing agent. It has been reported that baits containing sodium fluoride and sodium fluosilicate do not seem to be visited by bees. Sodium fluosilicate is the recommended killing agent in both cutworm and strawberry-root weevil baits.

## NEW PUBLICATIONS

**Bul. 310. The influence of cropping on the nitrogen, phosphorus and organic matter of the soil under irrigation farming, by J. E. Greaves and C. T. Hirst. Department of Bacteriology and Biochemistry.**

This bulletin reports the results of cropping tests over a period of 19 years. The nitrogen, phosphorus and organic matter of the soil were measured at the beginning and at the end to find just how much of these constituents was lost with different methods of cropping.

**Bul. 311. Water-application efficiencies in irrigation, by O. W. Israelsen, W. D. Criddle, D. K. Fuhriman, and V. E. Hansen. Department of Irrigation and Drainage in cooperation with the U. S. Soil Conservation Service.**

This bulletin gives the results of studies of the efficiency with which irrigation water is being used on representative Utah and Salt Lake County farms and suggests methods whereby it may be used to better advantage.

**Cir. 120. Tomato production in Utah, by L. H. Pollard, H. B. Peterson, H. L. Blood, and W. E. Peay. Departments of Vegetable Crops and Agronomy and Soils in cooperation with the U. S. Department of Agriculture.**

Information on desirable varieties, selection of plants, types of soil, method of transplanting, irrigation, culture, and control of diseases and pests of tomatoes under Utah conditions is brought together in this circular.

**Reprint 520. An analysis of the agricultural situation in the Wasatch Front area resulting from war and post-war changes.**

This report, prepared by the staff of the Utah Agricultural Experiment Station and published as part 2 of the cooperative planning program for Utah and the Wasatch Front by the Utah State Department of Publicity and Industrial Development, was designed to form the basis for a post-war planning program. It contains sections on soils and crops, range resources, irrigation resources and a program for future utilization of the agricultural resources.

**Any of these publications may be obtained free by addressing a card to the Utah Agricultural Experiment Station, giving number and series of the publication desired.**

# Comparative Hardiness of Peach Varieties and Selections

## Fifty-five Peaches and Nectarines at Logan Rated on Winter Injury in 1942

By FRANCIS M. COE

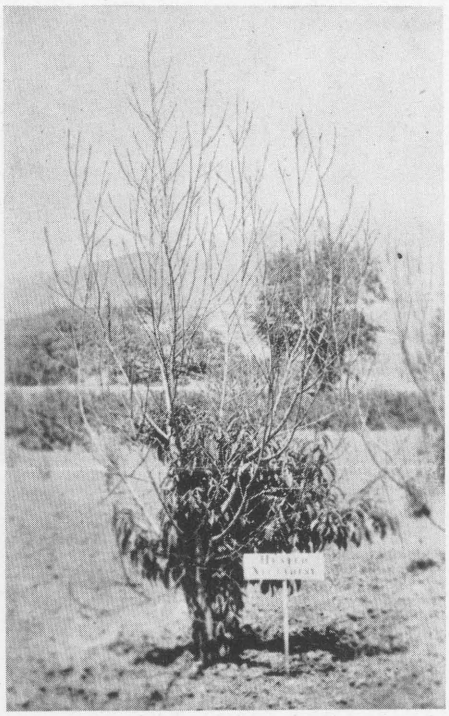
FOLLOWING the winter of 1937 which caused widespread loss to the peach crop by extensive killing of blossom buds, a survey was made to locate and propagate trees of both commercial varieties and seedling peaches which gave promise of having hardier buds, as evidenced by bearing a better crop than surrounding trees. Sixty-seven selections were budded for testing and included in a peach hardiness test planting on the Terry Trial Grounds at Logan where peaches are precariously hardy, and winter killing of buds and trees occurs more frequently than in the commercial peach districts of Utah. Additional new varieties were added in 1941, including the New Jersey hybrids. A collection of peach varieties was included to compare the newer varieties and selections with older sorts of known bud and tree hardiness.

This is the first progress report on this peach hardiness test orchard, based on extensive but variable injury done the trees during the winter of 1941-42, which varied from slight twig killing and black hearting, to killing all the tops of the trees above the snow line. The trees were left unpruned to facilitate recovery and to define better the extent of injury, and were rated from 1 to 5 the following spring, 1 representing very slight injury, 5 severe injury, killing back to snow line. These observations are summarized in table 1.

In comparing the varieties and selections listed, too much weight should not be given to the winter injury indexes given in this preliminary observation, especially where only one tree was available, since other variable factors, such as maturity and how much of a start the tree obtained the first year affect the extent of winter injury. It should be kept in mind that these data represent only one observation of comparative hardiness under one set of conditions. Certain trends and tendencies are evident, however, and may be useful in indicating which varieties are likely to prove hardiest.

As was to be expected, the Elberta and Early Elberta selections rated medium in hardiness, being surpassed by Veteran, Halehaven, and a number of others.

The data given refer to hardiness of wood only, as none of the trees bore fruit in 1942.



**Severely winter injured Hunter nectarine tree in experimental orchard. This tree is typical of those in class 5 with a winter injury index of 4.40 to 5.00. Such trees have to be rebuilt from the ground. Hardier varieties are one of the major objectives of the variety testing work of the Station**

### Table 1. Hardiness rank of 55 peach and nectarine varieties and selections, Logan, Utah, winter of 1941-42

| | |
|---|---|
| Group 1. Slight injury (Winter injury index 1.00-1.62*) | |
| Veteran | 1-40** |
| Larson Old Fashioned Elberta | 1-40 |
| Early Elberta 37-7 | 1-40 |
| Halehaven | 2-40 |
| John Rivers nectarine | 1-41 |
| Larson Hardy Bud 5/6S | 1-40 |
| Larson Early Elberta 10/5 | 4-40 |
| Group 2. Moderate injury (Winter injury index 1.83-2.50) | |
| Beecher Late Elberta type | 3-40 |
| Burbank Hale | 2-40 |
| Elberta 37/7 | 2-40 |
| Elberta 37/16 | 2-40 |
| Elberta 37/15 | 1-40 |
| Eclipse | 1-40 |
| Hardyberta | 1-41 |
| J. H. Hale 37/7 | 1-40 |
| J. H. Hale 37/4 | 1-40 |
| Johnson Early Elberta | 1-40 |
| Johnson Early Elberta No. 2 | 1-40 |
| Larson Early Elberta | 1-40 |
| Redelberta | 1-40 |
| Oriole | 1-41 |
| Manning Cling | 1-41 |
| Hardyberta | 1-41 |
| Elberta | 10-41, 42 |
| Klondyke Early Elberta | 3-40 |
| Carmen | 2-40 |
| Burbank Giant | 1-41 |
| Group 3. Moderately severe injury (Winter injury index 2.50-3.25) | |
| Afterglow | 4-41 |
| Early Elberta | 3-41, 42 |
| J. H. Hale | 4-41 |
| Raritan Rose | 3-41 |
| Candoka | 2-40 |
| Ideal | 2-40 |
| Valiant | 1-41 |
| Wahlberta | 1-40 |
| La Mar Valentine Hale | 6-40 |
| Triogem | 4-41 |
| Garden State nectarine | 4-41 |
| J. W. Jenson Hale | 4-40 |
| Pacemaker | 4-41 |
| Summercrest | 4-41 |
| Golden Jubilee | 2-40 |
| Group 4. Severe injury (Winter injury index 3.50-4.00) | |
| Newday | 5-41 |
| Goldeneast | 8-41 |
| Red Bird Cling | 1-40 |
| Midway | 3-41 |
| Flaming Gold nectarine | 4-41 |
| Halate | 2-41 |
| Blood nectarine | 1-41 |
| Redhaven | 1-41 |
| Mikado | 1-40 |
| Group 5. Very severe injury (Winter injury index 4.40-5.00) | |
| Halberta | 5-41 |
| Hunter nectarine | 1-41 |
| Early Elberta 3/4 | 1-40 |
| Eureka (Stark) | 1-41 |

*Refers to rating of winter injury assigned trees, those rated 1 being the least injured, those rated 5 the most injured, practically killed to the snow line.

**Date of planting. Those planted in 1941 had grown one season before injury took place; those planted in 1940 had grown two seasons. The numerals preceding the planting date indicate the number of trees of the variety observed in the test, hence the reliability of the winter injury index figure assigned the variety.

CONTENTS

## RASPBERRY VARIETIES

*(Continued from page 3)*

Cuthbert. In the plot averages, Newburgh was exceeded in yield by only one variety, a similar but unnamed New York seedling, 14443. Average yields and yield of the highest yielding plots for the varieties in the test are summarized in table 1.

**Table 1. Yields (in pints) of 14 raspberry varieties in 3 year old plots† at Logan, Utah, 1943**

| Variety | Mean yield of plots | Yield of highest-yielding plot |
|---|---|---|
| 14443* | 10.67 | 14.8 |
| Newburgh | 9.70 | 16.5 |
| Latham | 8.73 | 10.6 |
| 8111* | 7.45 | 15.5 |
| Washington | 6.95 | 9.6 |
| June Red | 6.66 | 9.6 |
| Taylor | 6.26 | 9.3 |
| 6520* | 5.90 | 6.7 |
| Sodus (purple) | 5.05 | 5.35 |
| Indian Summer (everbearing) | 5.07 | 10.7 |
| Cuthbert | 4.94 | 9.0 |
| 8126* | 4.64 | 8.8 |
| Tahoma | 4.52 | 8.8 |
| Marcy | 2.65 | 3.9 |
| Avg. yield | 6.35 | 10.09 |

*Numbers refer to New York Station seedlings under test.
†There were from 3 to 5 plots of each variety.

Too much importance should not be attached to differences in yields as given in table 1, since only one year's results in the first year of bearing are available, and the yields were affected considerably by variation in stand of plants and in irrigation the preceding year. However, the data largely agree with previous observations indicating that Newburgh, 14443, and Taylor are more productive than Cuthbert.

WASHINGTON is a new variety introduced by Dr. Schwartze of the Western Washington Experiment Station to replace Cuthbert, which has suffered frequent winter-killing in the Northwest. Tahoma is a companion variety from the same source. Washington appears the more promising of the two, having high quality fruits and being more hardy than average. The canes are vigorous and fill in the rows rapidly. The fruit is smaller than Newburgh, Taylor, and Latham in the Utah Station test plots at Farmington and Logan, and more difficult to pick. The fruit has shown up well in freezing tests, rating very good in flavor, and higher than average in sugar content. Tahoma has appeared the less promising of the two here.

New York (Geneva) Station seedlings nos. 14443 and 8126 have appeared most promising of the unnamed seedlings under test here. The 14443 is similar to Newburgh though somewhat hardier, but showed a higher percentage of sunburned fruit last season than the older parent variety. No. 8126 is an attractive early dark red tart variety of marked hardiness which should be especially suitable for ice cream and jam making because of its tart flavor. Fruit of this variety has not been as uniformly large as Newburgh or Taylor, nor as firm as the latter sort. It appears to merit further testing for freezing and jam purposes, and for colder locations. This variety is not available for public distribution until finally judged worthy of naming and introduction by the originators.

INDIAN SUMMER is a promising new everbearer with larger fruits than the older Ranere (St. Regis) commonly grown. The fruits are of good color and quality, but are softer than the standard varieties. Like all so-called everbearing raspberries, Indian Summer bears two crops, the summer crop in late June and July, and a fall crop in September and October, the latter on the new canes. The summer crop ripens with the earliest summer variety, June Red, and is valuable for early berries, but rather soft for market. It is primarily a raspberry for home use, although the summer crop can be used to advantage for frozen puree for ice cream, where firmness is not important. The variety has the fault of producing few canes and suckers, which makes its propagation slow.

SODUS is an interesting new purple-cane raspberry variety, one of a class of hybrids between the reds and the blackcaps. Showing great hybrid vigor, the fast growing canes lack hardiness and winter-kill worse than all the reds under test except Marcy. When not injured, the canes are extremely fruitful, the berries large, dull purplish red in color, highly flavored, and make richly colored and flavored jam and puree. Unfortunately, the seeds are objectionably large.

MARCY has been tested in Utah County by private experimenters and by the Station at Farmington and Logan. While showing up well as a frozen berry, its large, dark red, highly flavored berries receiving the commendation of the judges, unfortunately the canes are quite tender to winter-killing, and the yields are often seriously reduced as indicated in table 1.

JUNE RED is an older variety grown in a limited way for early market and home use. The canes are smooth, without prickles, but are produced in limited numbers. The fruit is large on the lower fruiting shoots, but often small and crumbly toward the ends of the canes. The color is light red, and the flavor mild and sweet.

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## PEACH ORCHARD FERTILIZERS

*(Continued from page 4)*

alone were inclined to ripen their fruit much earlier and more uniformly than trees receiving nitrogen, manure, or a combination of nitrogen and phosphorus. The effect of the fertilizer treatment on fruit color was especially noticable. Trees receiving phosphorus alone produced fruit of much higher color, which was invariably chosen by purchasers who came into the orchard and selected their fruit. The fruit from these trees appeared to have a higher sugar content, which is usually associated with higher color. Fruit from the trees fertilized with nitrogen alone was usually ten days to two weeks later than that harvested from the trees receiving superphosphate alone.

The influence of fertilizers on the color of the foliage and the general vigor of the tree was noticable. Vigor is usually correlated with yields and trees receiving nitrogen, nitrogen plus phosphorus, and barnyard manure showed greatest vigor. Trees receiving phosphorus alone and those receiving no fertilizer treatment showed least vigor as indicated by annual terminal shoot growth and annual increase in cross-section of trunk area.

In deciding fertilizer practices, growers should not be guided solely by the better color and eating quality of the fruit from the trees receiving no fertilizer or phosphorus alone. Even though the fruit excelled in these characteristics, yields were low and higher profits might be expected from trees fertilized with nitrogen plus phosphorus in combination where the fruit was of good commercial color and production much higher than on trees not fertilized or receiving phosphorus alone. On the basis of findings thus far, a combination of ammonium sulfate and treble superphosphate would produce the most fruit of good color, size and quality. Where barnyard manure is available, this should be used as far as possible, but where it is not a combination of commercial fertilizers and green manure or cover crops is most desirable.